HW02

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Homework 2

```
library(leaps)
library(caret)
```

```
Loading required package: ggplot2
```

```
Loading required package: lattice
```

```
library(tidyverse)
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.2 --
```

```
v tibble  3.1.8      v dplyr   1.0.10
v tidyr   1.2.1      v stringr 1.4.1
v readr   2.1.2      v forcats 0.5.2
v purrr   0.3.4
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
x purrr::lift()   masks caret::lift()
```

```
library(lars)
```

```
Loaded lars 1.3
```

```
library(ISLR2)
library(gam)
```

```
Loading required package: splines
Loading required package: foreach

Attaching package: 'foreach'

The following objects are masked from 'package:purrr':

    accumulate, when

Loaded gam 1.20.2
```

1. Load the College.csv file on Canvas into a dataframe called college (or give it any name you want). A description of the dataset can be found at https://www.rdocumentation.org/packages/ISLR2

```
college <- read.csv("College.csv")
```

2. Check if there are any missing values. Replace any missing values with the mean value for the column rounded up to the nearest integer. Hint: Lookup the ceiling function and use it.

```
missing <- which(is.na(college))
missingCol <- floor(missing / nrow(college)) + 1
missingCol
```

```
[1] 14 14 14 19 19
```

```
college$PhD[is.na(college$PhD)] <- ceiling(mean(college$PhD, na.rm = TRUE))
college$Grad.Rate[is.na(college$Grad.Rate)] <- ceiling(
  mean(college$Grad.Rate, na.rm = TRUE))
```

3. Remove the college name column from the dataframe as it is not useful in prediction

```
college <- college[, -1]
colnames(college)
```

```
 [1] "Private"     "Apps"        "Accept"      "Enroll"      "Top10perc"
 [6] "Top25perc"   "F.Undergrad" "P.Undergrad" "Outstate"    "Room.Board"
[11] "Books"       "Personal"    "PhD"         "Terminal"    "S.F.Ratio"
[16] "perc.alumni" "Expend"      "Grad.Rate"
```

4. Split the dataset into 80% training and 20% test

```
intrain <- createDataPartition(college$Top10perc, p = 0.8, list = FALSE)
train1 <- college[intrain, ]
test1 <- college[-intrain, ]
```

5. Fit a linear multiple regression model to the training set to predict graduation rate using all the other features/variables. What variables are significant at the p = 0.001 level? Predict the graduation rate using the test dataset and report the root mean squared error (RMSE) for the test dataset.

```
reg_model <- train(Grad.Rate ~ . , data = train1, method ="lm")
summary(reg_model)
```

```
Call:
lm(formula = .outcome ~ ., data = dat)

Residuals:
    Min      1Q  Median      3Q     Max
-41.480  -7.098  -0.347   6.743  52.753

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) 34.6338327  5.4601883   6.343 4.42e-10 ***
PrivateYes   4.6447654  1.9075815   2.435 0.015184 *
Apps         0.0011768  0.0005061   2.325 0.020386 *
Accept      -0.0011717  0.0010048  -1.166 0.244014
Enroll       0.0056675  0.0026199   2.163 0.030915 *
Top10perc    0.0472536  0.0813705   0.581 0.561645
Top25perc    0.1376176  0.0608409   2.262 0.024056 *
F.Undergrad -0.0007041  0.0004560  -1.544 0.123080
P.Undergrad -0.0014152  0.0004030  -3.511 0.000479 ***
Outstate     0.0007925  0.0002603   3.044 0.002433 **
Room.Board   0.0024481  0.0006428   3.808 0.000154 ***
Books       -0.0015545  0.0030927  -0.503 0.615405
Personal    -0.0019399  0.0008260  -2.348 0.019172 *
```

```
PhD           0.0934372  0.0638969   1.462 0.144175
Terminal     -0.1147990  0.0706807  -1.624 0.104856
S.F.Ratio     0.0905653  0.1773258   0.511 0.609728
perc.alumni   0.2970452  0.0542107   5.479 6.27e-08 ***
Expend       -0.0004307  0.0001970  -2.186 0.029176 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 12.41 on 605 degrees of freedom
Multiple R-squared:  0.4675,    Adjusted R-squared:  0.4525
F-statistic: 31.24 on 17 and 605 DF,  p-value: < 2.2e-16
```

```
# testprediction1 <- predict(reg_model, newdata = train1, method = "lm")
# postResample(pred = testprediction1, obs = train1$Grad.Rate)
## I used top10perc as a dataset to split, and got a R-squared = 0.4515 and RSE = 13.01 on
testpredictions <- predict(reg_model, newdata = test1, method = "lm")
postResample(pred = testpredictions, obs = test1$Grad.Rate)
```

```
      RMSE   Rsquared        MAE
14.3553612  0.4169691 10.5292539
```

```
## the rest root mean squared error (RMSE) is 12.4563567
```

6. Perform backward subset selection using the leaps library. Which model is best according to BIC? Are the variables chosen by the subset selection different from the list of statistically significant variables from fitting the linear regression model above? If so, which ones are different?

```
regfit_bwd <- regsubsets(Grad.Rate ~ ., data = train1, nvmax = 18, method = "backward")
reg_summary <- summary(regfit_bwd)
reg_summary
```

```
Subset selection object
Call: regsubsets.formula(Grad.Rate ~ ., data = train1, nvmax = 18,
    method = "backward")
17 Variables  (and intercept)
            Forced in Forced out
PrivateYes      FALSE      FALSE
Apps            FALSE      FALSE
Accept          FALSE      FALSE
```

```
Enroll          FALSE      FALSE
Top10perc       FALSE      FALSE
Top25perc       FALSE      FALSE
F.Undergrad     FALSE      FALSE
P.Undergrad     FALSE      FALSE
Outstate        FALSE      FALSE
Room.Board      FALSE      FALSE
Books           FALSE      FALSE
Personal        FALSE      FALSE
PhD             FALSE      FALSE
Terminal        FALSE      FALSE
S.F.Ratio       FALSE      FALSE
perc.alumni     FALSE      FALSE
Expend          FALSE      FALSE
1 subsets of each size up to 17
Selection Algorithm: backward
          PrivateYes Apps Accept Enroll Top10perc Top25perc F.Undergrad
1  ( 1 )  " "        " "  " "    " "    " "       " "       " "
2  ( 1 )  " "        " "  " "    " "    " "       " "       " "
3  ( 1 )  " "        " "  " "    " "    " "       "*"       " "
4  ( 1 )  " "        " "  " "    " "    " "       "*"       " "
5  ( 1 )  " "        "*"  " "    " "    " "       "*"       " "
6  ( 1 )  "*"        "*"  " "    " "    " "       "*"       " "
7  ( 1 )  "*"        "*"  " "    " "    " "       "*"       " "
8  ( 1 )  "*"        "*"  " "    " "    " "       "*"       " "
9  ( 1 )  "*"        "*"  " "    " "    " "       "*"       " "
10  ( 1 ) "*"        "*"  " "    " "    " "       "*"       " "
11  ( 1 ) "*"        "*"  " "    " "    " "       "*"       " "
12  ( 1 ) "*"        "*"  " "    "*"    " "       "*"       " "
13  ( 1 ) "*"        "*"  " "    "*"    " "       "*"       "*"
14  ( 1 ) "*"        "*"  "*"    "*"    " "       "*"       "*"
15  ( 1 ) "*"        "*"  "*"    "*"    "*"       "*"       "*"
16  ( 1 ) "*"        "*"  "*"    "*"    "*"       "*"       "*"
17  ( 1 ) "*"        "*"  "*"    "*"    "*"       "*"       "*"
          P.Undergrad Outstate Room.Board Books Personal PhD Terminal S.F.Ratio
1  ( 1 )  " "          " "      " "        " "   " "      " " " "      " "
2  ( 1 )  " "          " "      "*"        " "   " "      " " " "      " "
3  ( 1 )  " "          " "      "*"        " "   " "      " " " "      " "
4  ( 1 )  "*"          " "      "*"        " "   " "      " " " "      " "
5  ( 1 )  "*"          " "      "*"        " "   " "      " " " "      " "
6  ( 1 )  "*"          " "      "*"        " "   " "      " " " "      " "
7  ( 1 )  "*"          " "      "*"        " "   "*"      " " " "      " "
8  ( 1 )  "*"          "*"      "*"        " "   "*"      " " " "      " "
```

```
9  ( 1 )  "*"         "*"      "*"        " "   "*"      " " " " "      " "
10  ( 1 ) "*"         "*"      "*"        " "   "*"      " " "*"      " "
11  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      " "
12  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      " "
13  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      " "
14  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      " "
15  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      " "
16  ( 1 ) "*"         "*"      "*"        " "   "*"      "*" "*"      "*"
17  ( 1 ) "*"         "*"      "*"        "*"   "*"      "*" "*"      "*"
          perc.alumni Expend
1  ( 1 )  "*"         " "
2  ( 1 )  "*"         " "
3  ( 1 )  "*"         " "
4  ( 1 )  "*"         " "
5  ( 1 )  "*"         " "
6  ( 1 )  "*"         " "
7  ( 1 )  "*"         " "
8  ( 1 )  "*"         " "
9  ( 1 )  "*"         "*"
10  ( 1 ) "*"         "*"
11  ( 1 ) "*"         "*"
12  ( 1 ) "*"         "*"
13  ( 1 ) "*"         "*"
14  ( 1 ) "*"         "*"
15  ( 1 ) "*"         "*"
16  ( 1 ) "*"         "*"
17  ( 1 ) "*"         "*"
```

```
which.min(reg_summary$bic)
```

```
[1] 7
```

```
## in the last problem, I got my statistically significant variables are Outstate and perc
```

7. Fit a ridge regression model on the training set for predicting graduation rate using all the predictors, with chosen by 5-fold repeated cross-validation with 5 repeats. Predict graduation rate using the test dataset and report the test root mean squared error (RMSE). Report the value of used in the model.

```
ridge_fit1 <- train(Grad.Rate ~ ., data = train1, method = "ridge",
                    preProcess = c("scale", "center"))

ridge_fit1
```

```
Ridge Regression

623 samples
 17 predictor

Pre-processing: scaled (17), centered (17)
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results across tuning parameters:

  lambda  RMSE      Rsquared   MAE
  0e+00   12.75231  0.4221700  9.640608
  1e-04   12.75132  0.4222421  9.639980
  1e-01   12.62574  0.4355866  9.569255

RMSE was used to select the optimal model using the smallest value.
The final value used for the model was lambda = 0.1.
```

```
## the value of   is best fit when   = 0.1
```

8. Run the same ridge regression model above but this time use a grid of lamdas to search over. Use a grid of 50 values ranging from $\quad = 0.001$ to $\quad = 10000$. Report the $\quad$ that was chosen.

```
ridge_grid <- data.frame(lambda = seq(0.001, 10000, length = 50))
ridgefit2 <- train(Grad.Rate ~ ., data = train1, method = "ridge",
                   tuneGrid = ridge_grid, preProcess = c("scale", "center"))
ridgefit2
```

```
Ridge Regression

623 samples
 17 predictor

Pre-processing: scaled (17), centered (17)
```

```
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results across tuning parameters:
```

lambda	RMSE	Rsquared	MAE
0.0010	12.93671	0.4151900	9.742659
204.0826	41.74515	0.3848070	32.727655
408.1642	42.20226	0.3845674	33.085623
612.2458	42.35722	0.3844871	33.207032
816.3274	42.43519	0.3844469	33.268112
1020.4091	42.48214	0.3844227	33.304886
1224.4907	42.51350	0.3844066	33.329457
1428.5723	42.53594	0.3843951	33.347032
1632.6539	42.55278	0.3843864	33.360227
1836.7355	42.56589	0.3843797	33.370498
2040.8171	42.57639	0.3843743	33.378719
2244.8987	42.58498	0.3843699	33.385449
2448.9803	42.59215	0.3843662	33.391060
2653.0620	42.59821	0.3843631	33.395809
2857.1436	42.60341	0.3843605	33.399881
3061.2252	42.60791	0.3843582	33.403411
3265.3068	42.61186	0.3843561	33.406500
3469.3884	42.61534	0.3843544	33.409226
3673.4700	42.61843	0.3843528	33.411650
3877.5516	42.62120	0.3843514	33.413819
4081.6332	42.62370	0.3843501	33.415772
4285.7149	42.62595	0.3843489	33.417538
4489.7965	42.62800	0.3843479	33.419145
4693.8781	42.62988	0.3843469	33.420612
4897.9597	42.63159	0.3843460	33.421956
5102.0413	42.63317	0.3843452	33.423193
5306.1229	42.63463	0.3843445	33.424336
5510.2045	42.63598	0.3843438	33.425393
5714.2861	42.63724	0.3843432	33.426375
5918.3678	42.63840	0.3843426	33.427290
6122.4494	42.63949	0.3843420	33.428143
6326.5310	42.64051	0.3843415	33.428942
6530.6126	42.64147	0.3843410	33.429691
6734.6942	42.64237	0.3843405	33.430394
6938.7758	42.64321	0.3843401	33.431056
7142.8574	42.64401	0.3843397	33.431680
7346.9390	42.64476	0.3843393	33.432270
7551.0207	42.64547	0.3843389	33.432827

```
  7755.1023  42.64615  0.3843386  33.433356
  7959.1839  42.64679  0.3843383  33.433857
  8163.2655  42.64740  0.3843380  33.434333
  8367.3471  42.64797  0.3843377  33.434786
  8571.4287  42.64852  0.3843374  33.435218
  8775.5103  42.64905  0.3843371  33.435629
  8979.5919  42.64955  0.3843369  33.436022
  9183.6736  42.65003  0.3843366  33.436397
  9387.7552  42.65049  0.3843364  33.436756
  9591.8368  42.65093  0.3843362  33.437100
  9795.9184  42.65135  0.3843359  33.437429
 10000.0000  42.65175  0.3843357  33.437745

RMSE was used to select the optimal model using the smallest value.
The final value used for the model was lambda = 0.001.
```

```
## lambda was chosen to 0.001
```

9. Fit a Generalized Additive local regression (LOESS) model on the training set for predicting graduation rate using all the predictors. Do not specify a span so caret can choose a span. Report the span chosen by caret. Predict graduation rate in the test dataset and report the test root mean squared error (RMSE).

```
loess_model <- train(Grad.Rate ~ ., data = train1, method = "gamLoess")
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3460

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3565.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20182

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3565.7
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3040

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3565.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3565.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7453.2

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 41959

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 108.9

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7453.2

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 189.3

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 120

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 189.3

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
4.7

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.826

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
4.6
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.826

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.826

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
4.3

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.826

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
3.9

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.826

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10962

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7451

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1880

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2191

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
2146

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2191

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2191

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1920

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2191

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 3186
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 3197.6

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 41766

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37021

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37021

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 40386

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37021

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7450.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1880

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2299.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
2146

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2299.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
2217

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2299.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2299.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1920

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2299.5

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6180
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 5903.2

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 5903.2

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20188

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 41959
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
13

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 276.94

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4936.1

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6180

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 5903.2

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 5903.2

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1880

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1889

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1889

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20050

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20050

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2613.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
13

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4936.3

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.6

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3040

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 18837
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 21912

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 11017

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 3186

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 3268.9

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 108.9

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.925

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7755

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 11017

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
13

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.7

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7426.1
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
9310

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10221

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10962

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 18837

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 21913

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 108.9

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1880

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1889

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1889

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 11017

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1848.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20187
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2613

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 18744

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 21804

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 41766

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37022

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37022

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 40386

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 37022

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
63

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
60

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
58

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
60

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 27.916

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
28.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 27.916

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.5845

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
4.3

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.5845

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
3.9
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 4.5845

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 280.06

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4307.9

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4307.9

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7452.7
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1852.3

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 18744

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 20192

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 19972

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 21804

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 19972

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 19972

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 30639

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 33541

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 36854
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 41766

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 40386

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 29751

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
14

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
13
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7427.6

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1852.4

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.315

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.54

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.54

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.46

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
2
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.54

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.54

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
2

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.54

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.55

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.45
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.5

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.7

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 18837

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 21913

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 113.6

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2000

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 1406.4

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 1406.4

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.42

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 24.804

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
27.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 24.804

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
28.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 24.804
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.796

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 280.06

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4307.9

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4307.9

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 11017

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.7

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 18744

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 21804
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.5

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
300

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
300

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
350

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
300

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
300
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 368

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20185

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2954.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2954.7

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 110.6

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.4

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20050

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20050

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2613.7
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 108.9

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7453.2

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.7

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10962

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2605

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 18744

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 29082

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
30017

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 29082

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 21804

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 189.3
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 120

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 189.3

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
13

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 280.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4219.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4219.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4288

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4219.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
21700
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20047

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
upperlimit 20047

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3377.5

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3040

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3377.5

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3377.5
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 1.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7425.6

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1852.4

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3040

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3368.8

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 18837

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 48094
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 21913

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
63

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
60

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
58
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
60

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 54.27

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval
1

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1.53

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.42

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 15.58

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 110.6

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.4

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7205

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 267.5

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
9310

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10221

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10962

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 9099.3
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1848.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 29.65

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.5

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4936.3

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1780

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1848.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 3186

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 3268.9

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.685

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7453.2

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval
10962

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 10272

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 6210.7
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2605

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
63

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 60.3

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 60.3

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 194
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2000

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 1406

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 1406

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 120

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 194

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 276.94

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
6800

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
upperlimit 4936.1

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7400

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7262

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7398
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7425

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7350

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
7270

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7157.8

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3460

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3645.2
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2580

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3645.2

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
3040

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3645.2

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2700

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3645.2

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```r
# loess_model2 <- train(Grad.Rate ~ ., span = 0.3, data = train1, method = "gamLoess")
# summary(loess_model)
loess_model
```

```
Generalized Additive Model using LOESS

623 samples
 17 predictor

No pre-processing
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results:

  RMSE      Rsquared   MAE
  14.07034  0.3840673  9.897945

Tuning parameter 'span' was held constant at a value of 0.5
Tuning
 parameter 'degree' was held constant at a value of 1
```

```r
## the span chosen by caret is 0.5.
prediction <- predict(loess_model, newdata =  test1)
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval
2340

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2484.4

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 56233

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 45915
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
RMSE(prediction, test1$Grad.Rate)
```

```
[1] 14.62377
```

```
## the rest root mean squared error (RMSE) is 13.17063
```

10. Fit a Generalized Additive Spline regression model on the training set for predicting graduation rate using all the predictors. Do not specify a degree of freedom and let caret choose it. Report the degree of freedom chosen by caret. Predict graduation rate in the test dataset and report the test root mean squared error (RMSE).

```
gam_spline_model <- train(Grad.Rate ~ ., data = train1, method = "gamSpline")
prediction <- predict(gam_spline_model, newdata = test1)
RMSE(prediction, test1$Grad.Rate)
```

```
[1] 14.33412
```

```
## the rest root mean squared error (RMSE) is 12.41093
```